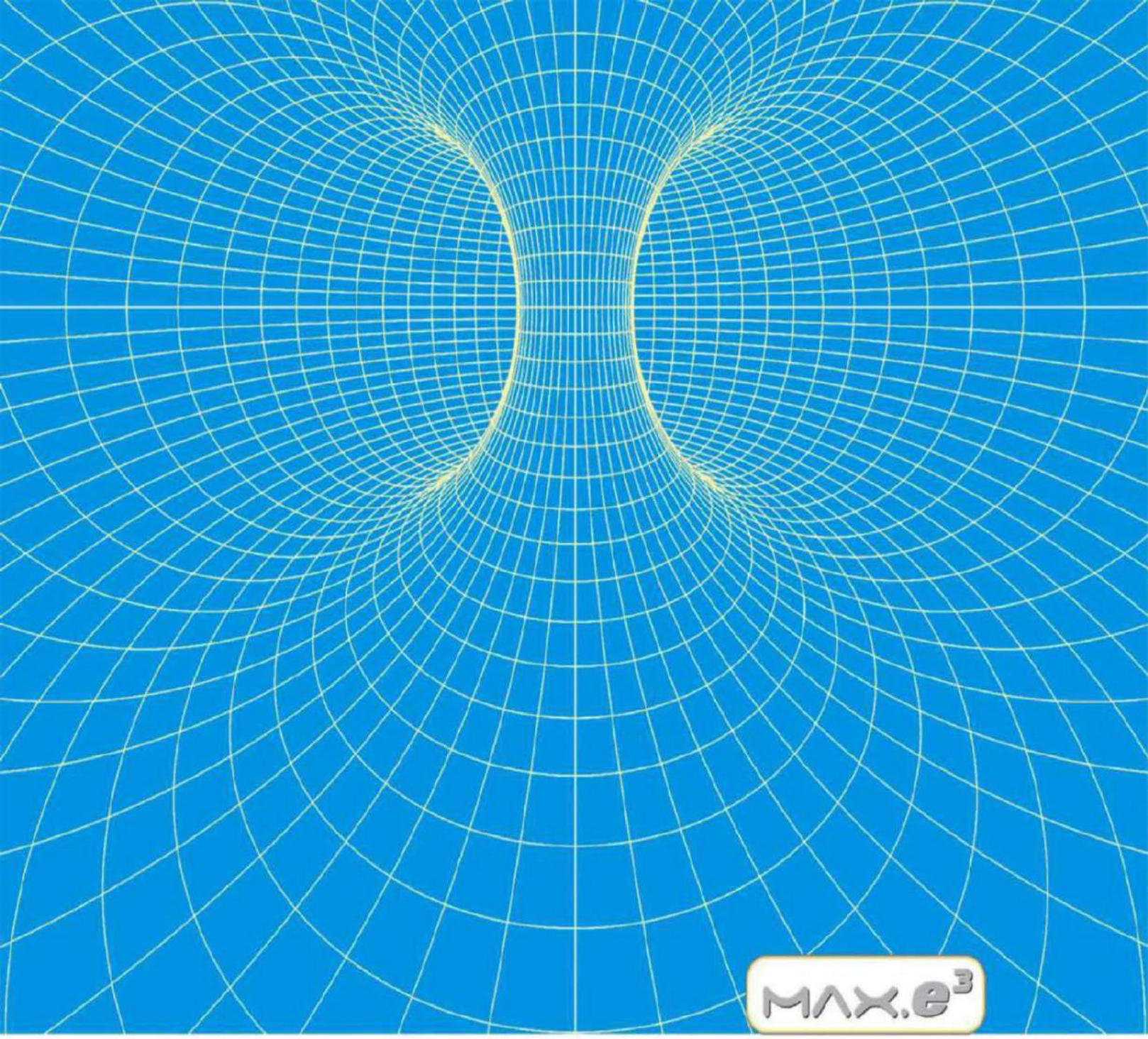


provocation ➡ challenge ➡ new concept?

Damvent

to reach...and exceed **Benelux**

History and Experience

In 2005, DAMVENT presented the first prototype of the Max.E solution. At that time, we were among the very first and few companies in Europe that had developed such a hybrid solution for fresh air.

Where are we now, 15 years later?

We have produced, delivered, installed and commissioned more than 1400 economizers in several EU territories with differing climates, such as: Bulgaria, Denmark, UK, Romania, Macedonia, Moldova, Ukraine, Estonia, Benelux, Greece, Sweden, Sri Lanka, Azerbaijan and the Middle East region.



Max.E

*Our experience and confidence is derived from the development of **3 generations** of "e-conomizers": **Max.E**, MAX.e² and MAX.e³*

***DV_Select** - Our simulation software designed to help every engineer (designer, consultant) get acquainted with the air treatment processes, both in the rotary heat exchanger and the plate heat exchanger, or in the reversible heat pump.*



Max.e2

***Focus** - Beginning with the first prototype of **Max.E**, we focused all our efforts on the continuous development of this solution, making it the the only one in our product catalogue.*

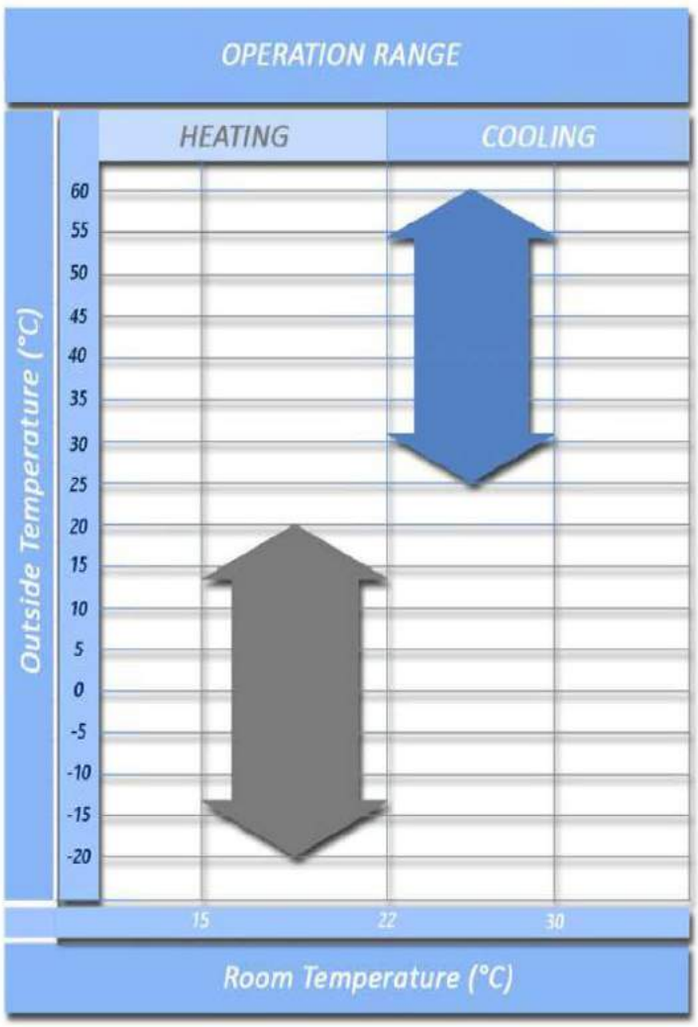
MAX.e² GULF - This unique "e-conomizer" was designed especially for the Middle East region (extreme hot and humid climate) and treats fresh air up to +60°C.



Max.e3

*In addition to the **Comfort Ventilation** segment, our "e-conomizers" are successfully applied in projects requiring **Process Ventilation** (where T and RH must be maintained within narrow limits) such as: hospitals, micro-electronics, food industry, chemical industry, and more.*

3e Concept



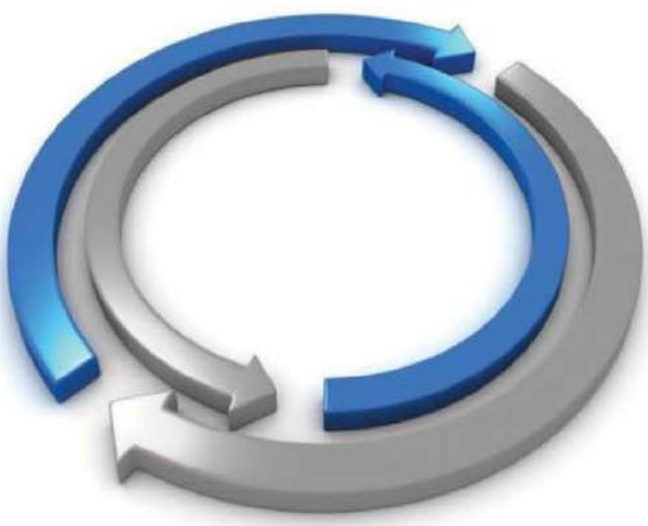
Every Climate – *from -25°C to +60°C (a widely extended temperature range in comparison with the MAX.@², reaching ambient temperatures of up to +60°C with the newly developed "e-conomizer" MAX.@³ GULF which was especially designed for a very hot and humid climate such as found in the Middle East.*

Every Application - *suitable wherever HVAC and 100% fresh air is needed because it can deliver all possible air-treatment processes, such as:*

- *Filtration*
- *Recirculation from 0-100%*
- *Heating / cooling / humidity recovery*
- *Heating*
- *Cooling + Dehumidification*
- *Humidification (optional)*

Every Installation - *suitable for all types of mounting both indoor (machinery rooms, technical floors, etc.) and outdoor (roofs).*

2 Stage Heating / Cooling / Humidity Recovery Technology



Recovers up to 100% of the extract heating / cooling. Achieved "consecutively" in 2 stages:

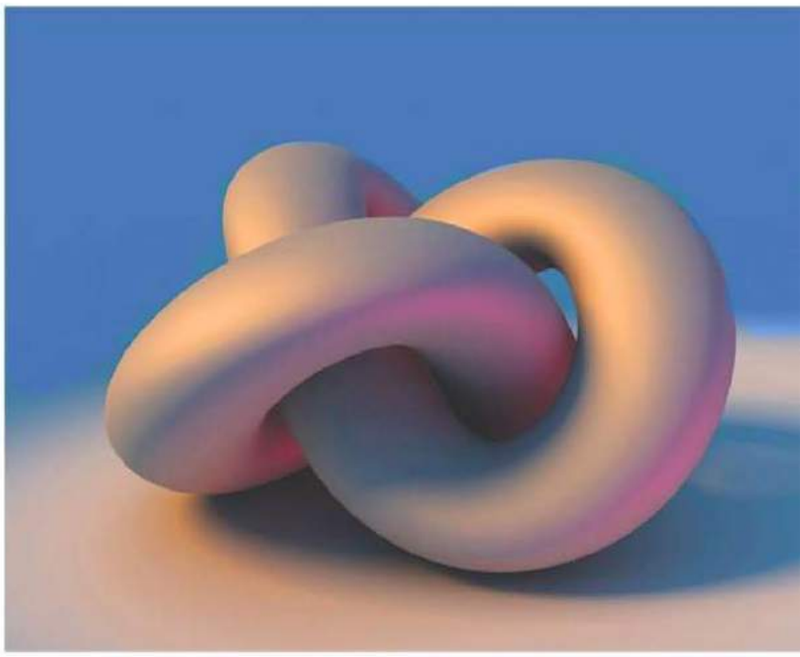
1st stage – *the sorption rotary heat exchanger recovers more than 70% of the heating / cooling and humidity.*

2nd stage – *the evaporator / condenser of the air-to-air heat pump recovers the rest, up to 100%.*

In relation to the latest EU regulations, which require the design of Passive, Low Energy Buildings (minimizing heating losses / cooling loads using innovative and efficient insulation materials and sun protection), then fresh air becomes the only necessary source for maintaining microclimate parameters..

"All-in-One" Concept

A multifunctional concept solution for fresh air (as well as for covering heating losses and cooling loads at once), which can practically solve the entire need for Air-Conditioning, Ventilation and Heating at the project site by using only air as fluid. Thus, radiators / fan coils / cassettes, boilers, chillers / VRF systems, pipes, insulations, pumps, fittings, etc., are no longer required. It only needs a duct system (which already exists in every conventional system) - and the correct designing of the necessary air quantity.



100% factory tested

High reliability and reduced installation costs, achieved by 100% factory tests. Each unit is tested under factory conditions. The test includes:

- *Leakage check*
- *Vacuuming and loading the system with the exact refrigerant quantity*
- *Functional testing of all fans and compressors*
- *Vibrations*
- *Loading the controller's software*
- *Temperature and pressure checks*
- *Setting up the required air flow*
- *Recording all parameters of the unit on the test list*

100% Plug & Play

A standalone "one-piece" unit which only needs a duct system and power supply for its start up.

100% DX unit

The MAX.@³ does not need additional water systems, and/or electric or DX heating / cooling coils, which makes it independent from additional heating / cooling sources (such as, boilers, gas, chillers, VRF systems, etc.).



CE *1853 en PED 97/23/EC, Category II, Module A1 - "Internal manufacturing checks with monitoring of the final assessment" certified by TUV-Rheinland.*

TÜVRheinland®



Cost Reduction

Thanks to the "All-in-One" concept, you can realize the following savings while using the MAX.@3 solution:

Initial investment costs – *in comparison with conventional HVAC equipment, investment costs are reduced by removing the need for: radiators / fan coils / cassettes, boilers, chillers/VRF systems, pipes, insulations, pumps, fittings, etc.*

Installation costs and labor.

Installed electric power *- Up to 30% reduction of the necessary installed power for a HVAC system.*

Energy and exploitation costs - *providing COP/EERnet = 5-15 , MAX.@3 ensures the lowest possible energy costs for HVAC (EUR/kWh)*

Service and Maintenance costs - *Filters are the only components that need to be checked, cleaned and replaced*

Time *- Time saved during design, installation works, start-up and commissioning, service, etc.*

Space *- whether the MAX.@3 is mounted indoor or outdoor, the absence of additional pipes, provides a "clean roof" view for the buildings*

BMS *- significantly reduces the costs for a BMS system regarding its HVAC part.*

New Models

In addition to the already existing models 02, 03, 06 and 09, two new models were developed as "standard": MAX.@3 -15 with maximum airflow of 15.000m3/h (replacing max.e-13.0) and MAX.@3 -18 with maximum airflow of 18.000m3/h.

Additionally, 3 larger models can be produced (only upon customer request): MAX.@3 models 25, 30 and 35, with maximum airflows of 25.000m3/h, 30.000m3/h and 35.000m3/h, respectively.

Reliability

The MAX.@3 models 06 and 09 are designed with 2 and 3 fans in parallel per side (supply and exhaust) and contain 2 compressors in tandem.

MAX.@3 models 15 and 18 are designed with 2 fans in parallel per side (supply and exhaust) and with 4 compressors in 2 refrigerant circuits.

MAX.@3 models 25, 30 and 35 are designed with 2 fans in parallel per side (supply and exhaust) and contain 8 compressors in 2 refrigerant circuits.

This generates the highest reliability and safety of the unit in case of failure of some of those components, as well as ensuring that the unit works continuously.

COP / SCOP / SPF

Higher than the highest standards!

According to **EN14825**, the highest Energy Efficiency Class for Heat Pumps is A+++ with a SCOP=3,75 (high temperature) -4,38 (low temperature).

With a SCOP=3.8-6.5 (of the refrigerant circuit) and a COPnet of the whole system SCOPnet= 5-15 , MAX.@3 is far ahead of the competition.

Note:
*SCOPnet - seasonal efficiency of a unit in active heating mode, without supplementary electric heaters which is determined from mandatory conditions given in this EU standard and used for marking, comparison and certification purposes



$$COPnet = \frac{Qrotary\ exchanger + Qheat\ pump}{Nfants + Ncompressores}$$

Where:

1. Q heat recovery - recovered heat in the rotary heat exchanger (kW)
2. Q heat pump - heating capacity of the condensor of the heat pump (kW)
3. N fans - energy consumption of both (supply and exhaust) fans (kW)
4. N compressors - energy consumption of the compressors (kW)

Performance

Improvements and advantages of the MAX.@3 compared to the MAX.@2:

Airflow - models 03, 06 and 09 are designed to cover up to 4.000, 8.000 and 11.000m3/h, which respectively is 25, 14,2 and 10% higher values than the same models of the MAX.@2

Increased Total Filtration Area(m2) by 45%.

Decreased Total Internal Pressure Drop (Pa) by **20-40%**, leading to even lower **SFP** numbers and energy consumption of the fans.
Total Internal Pressure Drops per side are lower than 300Pa.

Sound Pressure Level - reduced up to 5 dB(A).

Higher Total Heating Capacity (kW) by **30-35%** and COPnet of the whole system reaching **COPnet ≥ 15** . This is achieved by using a rotary heat exchanger and lower energy consumption of the fans.

30 - 45% Higher Total Cooling Capacity (kW) and respecctively up to **40%** higher EERnet = 5.5 in Summer mode thanks to the "soprtion type" rotary wheel.

Precise Condensing Temperature / Pressure control during the Summer mode.

Up to 78% humidity recovery during the Winter mode, improving the indoor climate comfort and reducing the need for additional humidifiers.

Stepless Capacity Control (standaard) allows superior Tsupply / Troom (°C) control and increases the efficiency during "**Part-Load**" operations; thus, increases the **ESEER/IPLV** and expands the lifetime of the compressors.

Sorption Cooling Recovery Technology

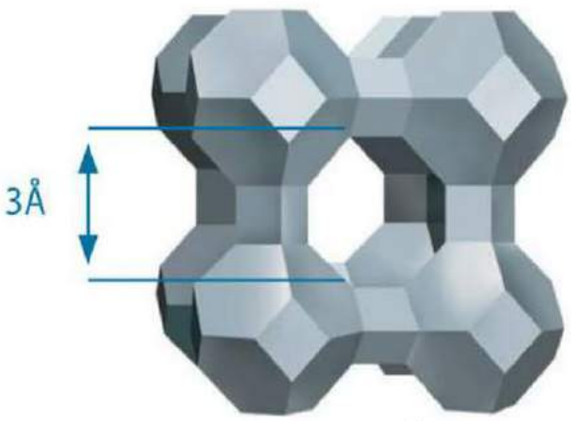


New Sorption Rotor Range, Molecular Sieve HX1 and HM1 - Molecular Sieve 3Å

- Lower investment cost in cooling
- Lower energy consumption in cooling period
- Better performance for dry cooling systems
- Lower investment costs and energy savings from day 1
- Helpful solution when cooling capacity is limited in existing systems

High Humidity Efficiency, up to 80%

Sorption rotors are providing an excellent method to pre-cool and dehumidify the fresh air before entering the DX cooling coil. Both Molecular Sieve (HX1) and Molecular Sieve (HM1) 3Å sorption wheels are giving exceptional high humidity transfer efficiencies.
In general, humidity efficiency is more or less equal to temperature efficiency.



Moleculaire Zeef 3Å Moleculen

3Å Molecular Sieve Gives High Selectivity for Absorbing Water Molecules (HM1 type)

- Molecular Sieve 3Å coating shows a high selectivity for absorbing water molecules.
- Recommended in situations where cross-contamination must be avoided.
- No odor problems

Lower running costs of ventilation and cooling systems

- Cooling recovery in Summer time
- Drying supply air with drier exhaust air, less water condensingin cooling coil
- Efficient dehumidification of fresh air in extreme conditions due to almost constant humidity efficiency, less need to increase water temperature

The Evolution in Fan Technology Continues

*Using **EC Blue** fans, MAX.e³ ensures the highest **IE4 Premium Efficiency** and **ErP** conformity - **2015/EC** controller integrated*

*The **EC Blue** fans are extremely light, stable, durable, quiet and efficient.*

*The high-performance composite material **Cpro ZAmid ®**, developed using the latest insights, makes the impeller significantly lighter than those made of steel and offers superior mechanical properties. **ZAmid ®**, provides new opportunities for system runtimes, enables lower power consumption and leads to a drastic reduction in noise.*

***Cpro ZAmid ®** is manufactured using a one-shot injection moulding process in a highly complex injection moulding machine, resulting in no welded joints. This highly technical process ensures the highest system reliability.*

Innovation at a Glance:

- *Significant weight reduction, which reduces motor bearing loads and increases the system service life*
- *Drastic reduction in noise generation*
- *Significant increase of the impeller efficiency, which reduces the absorbed power*
- *Reduced power consumption*
- *Up to 15% energy savings during operation*
- *Significant CO^2 reduction*
- *Improved mechanical properties in comparison to steel impellers*
- *No weld seams*
- *High peripheral velocities up to 70 m/s*
- *Can be combined with various types of motors*
- *Tonal noise reduction up to 5 dB*
- *Suitable for operational temperatures from -20°C to +80°C in comparison to steel impellers*
- *Corrosion-free*
- *No toxic gas emissions*
- *Colour-stable*

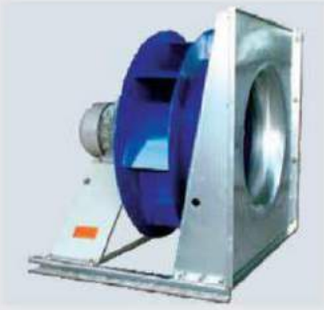
***Specific Fan Power (SFPe)** - even lower values in comparison with MAX.e² .*
***SFPe** ≤ 1700 W/m3/s total for the unit, and lower values can be reached by the MAX.e³ .*
*The **SFPe** calculation is based on clean filters and in accordance with **EN13779**.*

***SFPe** = (Psfm + Pefm) / Qmax [W/m3/s], where:*

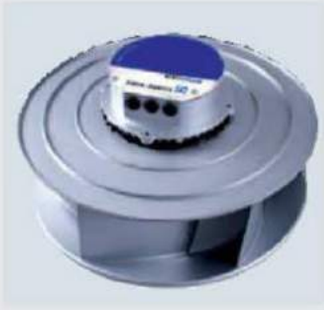
- *> Psfm = power supplied to the supply air fan (W)*
- *> Pefm = power supplied to the exhaust air fan (W)*
- *> Qmax = largest supply or extract airflow through the AHU (m3/h)*



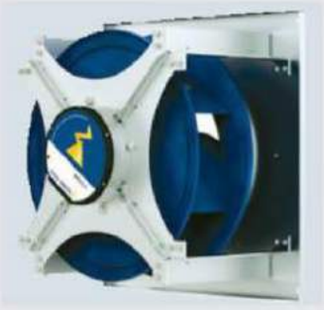
Standaard AHU



Max.E



Max.e2



Max.e3

Heat Pump

100% DX-unit - No additional water, electric or DX heating / cooling coils are needed in the MAX.@3, which makes it independent from other additional heating / cooling sources (i.e., boilers, chillers, VRF systems, etc.) All the DX coils used in MAX.@3 are EUROVENT Certified.

The refrigerant circuit is semi-hermetic and contains 1 or 2 circuits, depending on the size of the unit. The refrigerant used is eco-friendly **R407C**.

The MAX.@3 models 03, 06, 09, 15, 18, 25, 30 and 35 use "Scroll" compressors (1, 2, 4, 6 or 8 pieces, respectively, depending on the size of the unit).

All of the MAX.@3 units contain high efficiency direct expansion coils which are made from copper tubes, aluminum fins and equipped with a condensate drain pan. Both coils are epoxy coated, extending their useful life and also their best levels of performance.

Stepless Capacity Control

- Precise control and capacity controlled compressors provide continuous, stepless modulation over a wide range (from 30 - 100%), with no operating envelope restriction. As a result, ambient temperature and humidity can be tightly controlled for superior comfort and load variations can be quickly followed for improved seasonal efficiency.

- Stepless heating / cooing capacity control

- Increased European Seasonal Energy Efficient Ratio / Integrated Part Load Value (ESEER / IPLV) values are achieved by reducing the power input in part load operations.

- Constant Supply Temperature - superior control of the supply air temperature (± 0,5 ÷ 1°C) is managed, avoiding unpleasant temperature differences, and thus significant improvement to comfort in the room.

- Higher Reliability - Compressor cycling is reduced to a minimum ensuring optimum system efficiency and longer life expectancy of the equipment.



Connectivity & Mobility

Permanent Internet Connection

All hybrid units allow an internet circuit board to be connected to the ICB controller for internet connection. The built-in circuit board allows for a permanent internet connection to each MAX.@ from any location in the world. This option helps you/us react to situations that require fast and accurate solutions.

Building Management System (BMS)

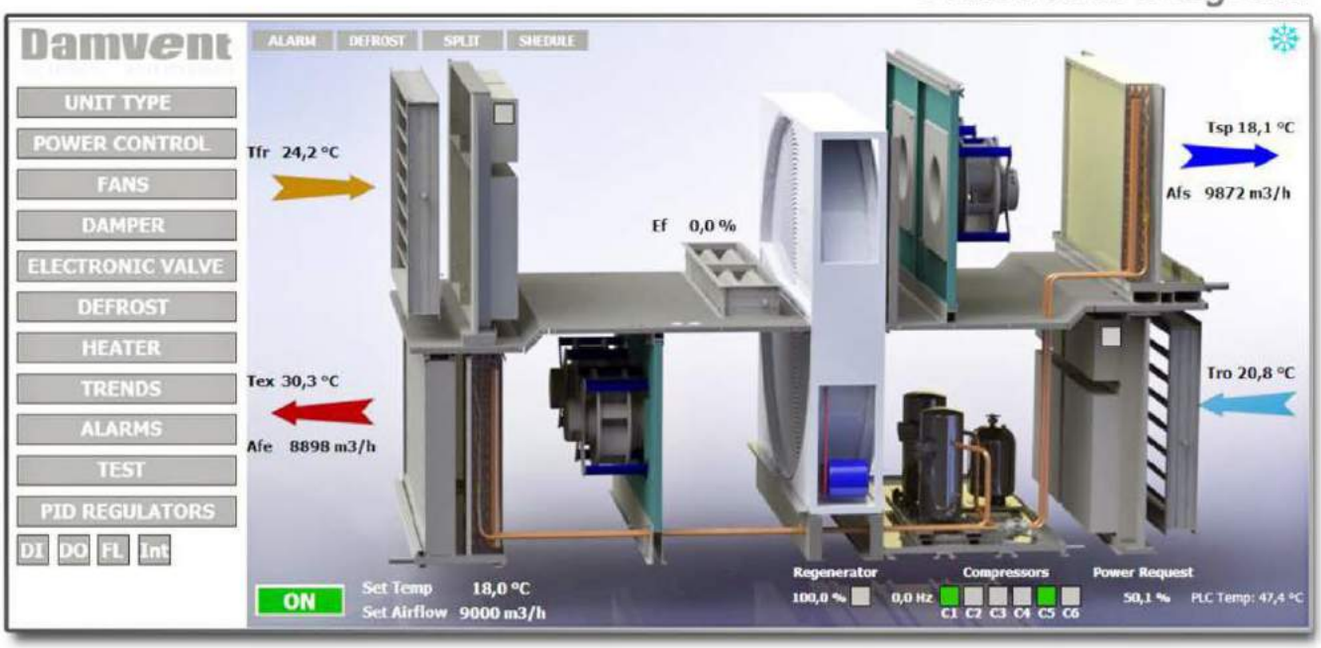
The automation system is provided with the option to communicate with different BMS, to constantly manage and monitor all its processes. This option requires different communication protocol types, which demand their relevant convertors. The standard connection and communication with the controller are performed by using ***Modbus RS485.***

Possibilities of the WEB Communicator

- *Remote start-up and 72 hours monitoring during trial period.*
- *Software updates, changing parameters and settings.*
- *Creation of history logs regarding the operation of the unit and service details (data created with help from the Supervision Control and Data Acquisition (SCADA).*
- *Monitoring of variables and working parameters in real time.*
- *Diagnosis of problems that arise during the operation of the unit.*



Functional Diagram



DV_Select 3.1

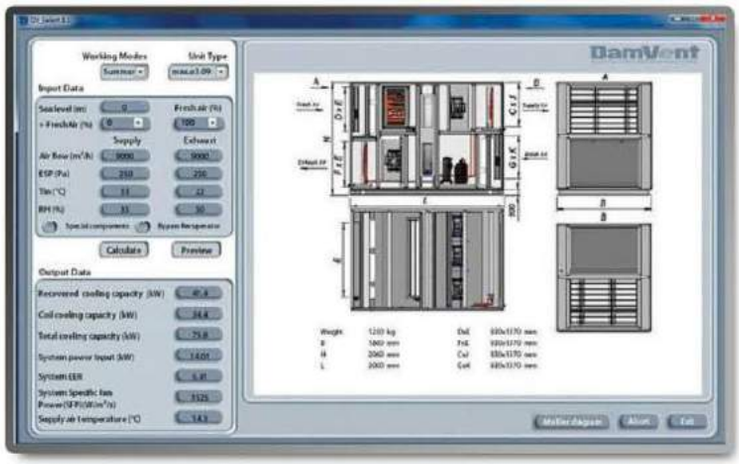


The Most Important Tool for Every Designer / Consultant

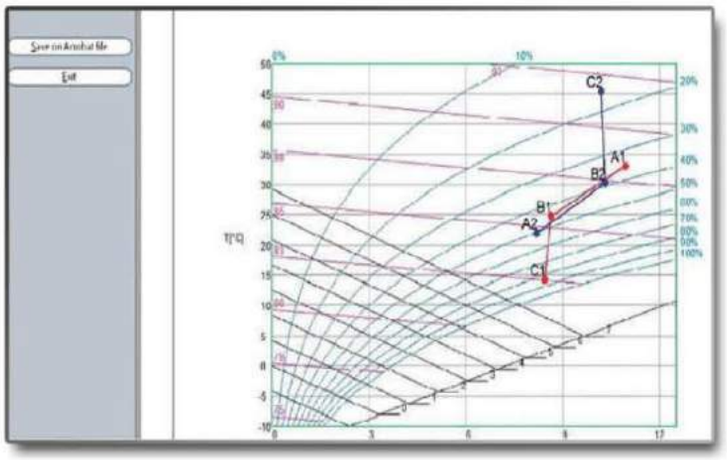
*Our new 3rd generation software, **DV_Select 3.1**, functions as a help menu for all our economisers MAX.e MINI, MAX.e², MAX.e³, MAX.e³POOL en MAX.e³ GULF.*

Presently, Damvent is among the few companies that successfully provide software for such developed hybrid solutions.

The main features of the new software are:



- ***User friendly** interface, works simple and fast.*
- ***Winter / Summer** calculations – Technical data and drawing printouts can be exported to PDF documents.*
- ***General information** - includes the most important parameters of the unit such as:*
  - *Total cooling / warming capacity (kW)*
  - *Temperature supply air (°C)*
  - *Total input power (kW)*
  - *COP / EERnet*
  - *Specific fan power (SFPe)*
  - *Total for the unit (W / m3 / s)*
  - *Refrigerant type*
  - *Power supply (V / ph / Hz)*
  - *Sound pressure level (dB)*
- *Visualization of all processes of air treatment available in a Mollier diagram.*



Environment

100% Eco-Friendly System

The MAX.@³ only supplies filtered and thermodynamically treated air to interior spaces. Because the units are not installed indoors, there is no risk of refrigerant leaking and no piping required.



Low Refrigerant Content -

*Each unit contains a modest refrigerant charge in accordance with **EU Regulation No. 842/2006** which requires more frequent control as the load of individual circuits increases.*

The MAX.@³ only needs to be controlled once a year in optimum conditions.

> *Refrigerant - eco-friendly*
> *Respect for the environment*

R407C





General Technical Data

Type		MAX.E3-02	MAX.E3-03	MAX.E3-04	MAX.E3-06	MAX.E3-09	MAX.E3-15	MAX.E3-18	MAX.E3-25	MAX.E3-30	MAX.E3-35
Min/max airflow (m3/h)	m3/h	1000/2000	2000/3200	2000/4000	4000/7000	5500/10000	9000/15000	13000/18000	20000/25000	20000/30000	30000/35000
	General Technical Data										
Nominal Airflow	m3/h	1500	2500	3500	6000	9000	13000	16000	20000	25000	30000
Cooling Capacity (1) (Summer mode)	kW	15,1	24,6	31,6	56,2	78,6	118,4	143,3	195,8	236,4	274,5
Heating Capacity (2) (Winter mode)	kW	26,3	46,3	60,3	107,1	154,8	225,5	274,2	369	449,2	525,2
Total Input Power (comp + fans) (2)	kW	7,7	10,0	10,8	20,0	26,6	37,8	45,6	76,6	95,0	98,4
Total Installed Power (comp + fans)	kW	3,5	6,3	7,4	12,3	14,8	25,3	30,5	52,7	57,0	60,1
Full Load Current	A	20,8	22,1	22,5	44,2	53,0	85,2	93,6	185,1	214,2	215,8
EER Net (2) (Summer mode)		4,1	3,89	4,28	4,46	5,32	4,69	4,70	3,72	4,15	4,57
COP Net (1) (Winter mode)		12,0	11,9	12,6	13,2	15,3	13,7	13,7	11,2	12,1	12,7
Standaard weight (options change weight)	Kg	920	1030	1030	1500	1770	2660	3230			
Connection Voltage	V/Ph/Hz	400 / 3 / 50									
FANS		Type – EC Plug fan									
Motor Efficiency	%	IE5 Premium Efficiency, ErP conformity – 2015/EC integrated controller									
Specific Fan Power (SFP)	W/(m3/s)	1726	1450	1450	1460	1554	1620	1804			
Installed Motor Power: Supply side Exhaust side	kW	2,5 2,,5	2,5 2,5	2,5 2,5	2 x 2,5 2 x 2,5	3 x 2,5 3 x 2,5	2 x 3,6 2 x 3,6	2 x 5,2 2 x 5,2			
Installed Current: Supply side Exhaust side	A	4,0 4,0	4,0 4,0	4,0 4,0	2 x 4,0 2 x 4,0	3 x 4,0 3 x 4,0	2 x 5,8 2 x 5,8	2 x 8,4 2 x 8,4			
Protection Class	IP	55									
Static Pressure Inlet / outlet ΔPs	Pa	250									
Rotary Heat Exchanger (sorption type)		Aluminum fins with molecular sieve (HM1)									
Efficiency – Temp / Hum.	%	77,1 / 79,4	76,7 / 78,9	71,5 / 72,6	75,6 / 77,6	74,4 / 76,2	74,7 / 76,5	73,0 / 74,4			
Recovered Heating Capacity – Winter mode (1)	kW	21,9	36,2	47,0	85,6	126,3	182,9	219,7			
Mass Transfer Humidity - Winter mode (1)	l/h	10,6	17,6	22,6	41,4	61,0	88,5	105,9			
COMPRESSOR	TYPE	Rotary	Scroll								
Number of Compressors		1	1	1	2	2	4	4			
Number of Circuits		1	1	1	1	1	2	2			
Power Input – Winter	kW	1 x 1,46	1 x 2,91	1 x 3,25	2 x 2,77	2 x 3,11	4 x 2,66	4 x 3,09			
Power Input – Summer	kW	1 x 2,83	1 x 5,37	1 x 5,88	2 x 5,02	2 x 5,48	4 x 4,88	4 x 5,75			
Full Load Current	A	1 x 12,8	1 x 14,1	1 x 14,5	2 x 14,1	2 x 14,5	4 x 14,1	4 x 14,5			
EER – Summer mode (2)		2,76	2,33	2,76	2,77	3,37	2,96	3,08			
COP – Winter mode (1)		2,92	3,48	4,08	3,89	4,58	4,01	4,41			
FILTERS	TYPE	Microcell Filters									
Filtration Class (EN779:2012)	M	M6	M6	M6	M6	M6	M6	M6			
Filtration Efficiency	%	60 - 80	60 - 80	60 - 80	60 - 80	60 - 80	60 - 80	60 - 80			
Total Filtration Area	M2	18,6	24,8	24,8	37,2	43,4	65,1	65,1			

(1) Room Air 22°C / 50%, Fresh Air -15°C / 80%
(2) Room Air 26°C / 50%, Fresh Air 34°C / 44%

**These figures are representative and may vary based on customer specifications, components used, and factory improvements.*

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